

**Amendments to the Claims:**

This listing of claims will replace all prior versions, all listings, of claims in the application:

**Listing of Claims:**

- 5 Claim 1 (Currently Amended): A variable gain amplifier, comprising:  
an amplifying stage for generating an output voltage according to an input voltage;  
and  
a variable gain stage coupled to the amplifying stage by using a current mirror  
structure for adjusting a voltage gain of the amplifying stage according to at  
10 least a controlling voltage;  
wherein the denominator of the voltage gain is a simple exponential function, the  
voltage gain is decreasing while the controlling voltage is increasing, and the  
value of the simple exponential function is determined by the controlling  
voltage is determined according to the subtraction between a first controlling  
15 voltage and a second controlling voltage.

- Claim 2 (Original): The variable gain amplifier of claim 1, wherein the simple  
exponential function comprises a function which raises a base to the power of an  
argument, without an addition operation or a subtraction operation with a constant  
20 being performed on the function.

- Claim 3 (Currently Amended): The variable gain amplifier of claim 1, wherein ~~the at~~  
~~least one controlling voltage comprises a first controlling voltage and a second~~  
~~controlling voltage, and the value of the simple exponential function is determined~~  
25 ~~by the difference between the first and the second controlling voltages.~~

- Claim 4 (Original): The variable gain amplifier of claim 3, wherein the variable gain  
stage is a transconductance amplifier for generating a gain current according to the  
difference between the first and the second controlling voltages.  
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- Claim 5 (Original): The variable gain amplifier of claim 4, wherein the variable  
gain stage comprises:



third transistor;  
a fourth transistor;  
a third current source coupled to the emitter of the third and the fourth transistors for  
providing a third current; and  
5 a fourth current source for generating the second current;  
whereby the ratio between the third current and the first current is substantially  
equivalent to the ratio between the second current and the gain current.

Claim 10 (Original): The variable gain amplifier of claim 9, wherein the current  
10 transforming unit further comprises:  
a third resistor coupled between the collector of the third transistor and the fourth  
current source; and  
a fourth resistor coupled between the collector of the fourth transistor and the fourth  
current source.

15 Claim 11 (Original): The variable gain amplifier of claim 9, wherein the transresistance  
amplifying unit comprises:  
a fifth transistor, the base and the collector of the fifth transistor being coupled to the  
base of the fourth transistor;  
20 a sixth transistor, the base of the sixth transistor being coupled to the base of the  
third transistor;  
a seventh transistor, the base and the collector of the seventh transistor being  
coupled to the emitter of the fifth and the sixth transistors;  
a fifth current source coupled to the input unit and the collector of the fifth transistor  
25 for providing a fifth current; and  
an output resistor coupled to the collector of the sixth transistor for generating the  
output voltage.

Claim 12 (Currently Amended): The variable gain amplifier of claim 3, wherein the  
30 voltage gain is expressed as  $C1 \times \exp(C2(V1 - V2)) / \exp(C2(V1 - V2)/Vt)$ , wherein  
both C1 and C2 are constant values, V1 is the first controlling voltage, Vt is the  
thermal voltage, and V2 is the second controlling voltage.

Claim 13 (Original): The variable gain amplifier of claim 1, wherein the variable gain amplifier is the half-circuit of a differential amplifier.

5 Claim 14 (Currently Amended): A variable gain amplifier, comprising:  
an amplifying stage for generating an output voltage according to an input  
voltage; and  
a variable gain stage coupled to the amplifying stage by using a current mirror  
structure for adjusting a voltage gain of the amplifying stage according to at  
10 least a controlling voltage;  
wherein the voltage gain ~~changes~~ increases linearly in decibel ~~in response to~~  
while the controlling voltage decreases and the controlling voltage is  
determined by the subtraction between a first controlling voltage and a  
second controlling voltage.

15 Claim 15 (Previously Presented): The variable gain amplifier of claim 14, wherein  
the voltage gain changes linearly in decibel with respect to a simple exponential  
function, and the value of the simple exponential function is determined by the  
controlling voltage.

20 Claim 16 (Previously Presented): The variable gain amplifier of claim 15, wherein  
the simple exponential function comprises a function which raises a base to the  
power of an argument, without an addition operation or a subtraction operation  
with a constant being performed on the function.

25 Claim 17 (Currently Amended): The variable gain amplifier of claim 14, wherein ~~the~~  
~~at least one controlling voltage comprises a first controlling voltage and a second~~  
~~controlling voltage, and~~ the voltage gain changes linearly in decibel according to  
the difference between the first and the second controlling voltages.

30 Claim 18 (Previously Presented): The variable gain amplifier of claim 17, wherein  
the variable gain stage is a transconductance amplifier for generating a gain

current according to the difference between the first and the second controlling voltages.

5 Claim 19 (Previously Presented): The variable gain amplifier of claim 18, wherein the variable gain stage comprises:

a first transistor coupled to the first controlling voltage;

a second transistor coupled to the second controlling voltage;

a first current source coupled to the emitter of the first and the second transistors for providing a first current; and

10 a second current source for generating the gain current, wherein the value of the gain current is determined by the first current and the difference between the first and the second controlling voltages.

15 Claim 20 (Previously Presented): The variable gain amplifier of claim 19, wherein the variable gain stage further comprises:

a first resistor coupled between the collector of the first transistor and the second current source; and

a second resistor coupled between the collector of the second transistor and the second current source.

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Claim 21 (Previously Presented): The variable gain amplifier of claim 18, wherein the amplifying stage comprises:

an input unit coupled to the input voltage for generating an input current according to the input voltage;

25 a current transforming unit for generating a second current according to the gain current; and

a transresistance amplifying unit for generating the output voltage, wherein the value of the output voltage is determined by the input current and the second current.

30 Claim 22 (Previously Presented): The variable gain amplifier of claim 21, wherein the input unit comprises an input transistor coupled to the input voltage for generating the input current according to the input voltage.

Claim 23 (Previously Presented): The variable gain amplifier of claim 21, wherein the current transforming unit comprises:

- 5 a third transistor, the collector of the third transistor being coupled to the base of the third transistor;
- a fourth transistor;
- a third current source coupled to the emitter of the third and the fourth transistors for providing a third current; and
- a fourth current source for generating the second current;
- 10 whereby the ratio between the third current and the first current is substantially equivalent to the ratio between the second current and the gain current.

Claim 24 (Previously Presented): The variable gain amplifier of claim 23, wherein the current transforming unit further comprises:

- 15 a third resistor coupled between the collector of the third transistor and the fourth current source; and
- a fourth resistor coupled between the collector of the fourth transistor and the fourth current source.

20 Claim 25 (Previously Presented): The variable gain amplifier of claim 23, wherein the transresistance amplifying unit comprises:

- a fifth transistor, the base and the collector of the fifth transistor being coupled to the base of the fourth transistor;
- a sixth transistor, the base of the sixth transistor being coupled to the base of the
- 25 third transistor;
- a seventh transistor, the base and the collector of the seventh transistor being coupled to the emitter of the fifth and the sixth transistors;
- a fifth current source coupled to the input unit and the collector of the fifth transistor for providing a fifth current; and
- 30 an output resistor coupled to the collector of the sixth transistor for generating the output voltage.

~~Claim 26 (Currently Amended):~~ The variable gain amplifier of claim 17, wherein the voltage gain is expressed as  $\frac{C1}{\exp(C2(V1-V2)/Vt)}$   ~~$C1 \times \exp(C2(V1-V2))$~~ , wherein both C1 and C2 are constant values, V1 is the first controlling voltage, Vt is the thermal voltage, and V2 is the second controlling voltage.

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Claim 27. (Cancelled)